A plea for evidence in ecosystem service science: a framework and its application
Supplementary material

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We applied the evidence-based concept to 12 case studies, 3 of them already mentioned in the main document. The details about the context, facet, the design as well as the critical appraisal (the quality assessment) are given in Table S1. We further present the quality checklist that was used to determine the study quality in all 12 case studies (Table S2). We covered a broad range of case studies, providing an example for all facets (quantification, valuation, management and governance) and all different study designs.

Table S1: Studies ranked according to the evidence-based approach. The key columns (grey section) are the question, the outcome and the final level of evidence (LoE). They are supported by context, facet and the evidence assessment with study design and quality assessment (critical appraisal).

	1. Question, outcome and the context					2. Evidence Assessment			
Reference	Context: Ecosystem services; Ecosystem(s); Location	Facet	Question investigated	Outcome	Final level of evidence	2a. Study design ->	Level of evidence	2b.Quality points (see checklist S2) ->	Quality score
Bowler et al. 2010	Air conditioning in urban space; cities; global	Management	Can human exposure to heat be mitigated by greening urban spaces	Green space in an urban area is on average 1°C cooler, than a built-up site.	LoE1	Systematic review	LoE1a	24/26	0.92
Lindhjem 2007	Non-timber forest ecosystem services, mainly recreation; forests; Norway, Sweden, Finland	Valuation	Review of people's willingness to pay for non-timber forest ecosystem services and explain systematic variation	Willingness to pay (WTP) is insensitive to forest size; WTP is higher if people are asked as individuals than on behalf of their households	LoE2	Conventional review	LoE1b	20/27	0.74
Ayanu et al 2012	Crops and biomass production, above ground carbon storage, amount of pollutants removed from the air, soil retained, water purification, storm mitigation, pest control; all; global	Quantification	Analysing advantages and disadvantages of several remote sensing procedures	Description of various remote sensing techniques. Claim for more studies assessing validity, reliability and uncertainty of remote sensing procedures in quanitiying and mapping ecosystem services	LoE2	Conventional review	LoE1b	10/18	0.56
Liu et al. 2008	Timber, soil erosion, carbon sequestration, recreation through wildlife observing; forests; China	Governance	Effects of Payment for Ecosystem Services (PES) - What is the socioeconomical and ecological impact of two in China implemented PES programs?	Socialeconomical impact: positive&negative, e.g. total income increased, decline in local revenues for local governments. Ecological benefits: Timber harvest decreased but timber import increased. Carbon sequestration increased, area suffering from soil erosion declined.	LoE4	Conventional review	LoE1b	5/20	0.25
Millar et al. 2010	Soil erosion protection; grassland; USA	Quantification	Investigating the effect of sod farming on soil loss.	Net loss of productive soil under sod farming is larger than the tolerable soil loss.	LoE3	Case-control	LoE2	14/25	0.56
Acuna et al. 2013	Food (fish), retention of organic and inorganic matter; river,forests; Iberian Peninsula	Management	How does adding dead wood to stream channels affect the provision of selected ecosystem services?	Restoration of natural wood loading in streams greatly increases the ecosystem services they provide.	LoE3	Before-after control-impact	LoE2	14/24	0.58
Lara et al. 2009	Food (fish); marine; mediterranean	Quantification	Developping an index that estimates fish density, biomass and production in dependance of environmental variables	Index etimating fish density, biomass and production in dependance of surface area/volume ratio, water volume with sufficient oxygen, conductivity, cholorphyll a concentration perimeter	LoE4	Correlative	LoE3	10/19	0.53
Barkmann et al. 2008	Fibre, water, recreation/biodiversity, cacao; agroforestry; Indonesia	Valuation	What is the value of the central ecosystem services the hydrological ecosystem provides?	Willingness to pay for improving water availability equals about 1% of mean cash income of households.	LoE5	Regression model	LoE3	10/20	0.50
Xie et al. 2011	Improved air quality; city; China	Quantification	Quantification of CO_2 sequestration, O_2 production, dust removal of different plant species	Absolute numbers for CO_2 sequestration, O_2 production and dust removal and the differences between plant species	LoE5	Descriptive	LoE4	8/18	0.44
Karimzadegan et al. 2007	gas regulation, pollination, pest control and others; forests; Iran	Valuation	What is the value of Irans forests and rangeland ecosystem services	A value [$] for Irans forests and rangeland	LoE5	Descriptive	LoE4	8/21	0.38
Entenmann and Schmitt 2013	Biodiversity; forests; Peru	Governance	Do stakeholders relate REDD+ to biodiversity conservation?	Yes, synergies between REDD+ and biodiversity conservation were assumed.	LoE5	Descriptive	LoE4	10/20	0.50
Desanker 2005	climate stabilisation; all; Africa	Governance	How can the Clean Development Mechanism better engaged in Africa?	Projects should be initiated by locals rather than esternal groups, additional CDM fund - not only carbon money, values from forest products and services should be factores into the economic Analysis	LoE5	Expert opinion	LoE5	not required, it is already on the lowest level of evidence	

Table S2: **Quality checklist** used to obtain the quality points (2b in Table S1)

		Reference:	Bowler et al. 2010	Lindhjem 2007	Ayanu et al 2012	Liu et al. 2008	Millar et al. 2010	Acuna et al. 2013	Lara et al. 2009	Barkmann et al. 2008	Xie et al. 2011	Karimzadegan et al. 2007	Entenmann and Schmitt 2013	Desanker 2005
	1	**Correspondence (Does the question match the answer?)**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	
	2	Are the assumption used in the study reasonable?	yes	yes	yes	/	yes	yes	yes	yes	yes	yes	no	
	3	Internal validity: Do design and implementation avoid a high risk of bias?	yes	yes	no	no	yes	yes	no	yes	no	no	no	
	4	External validity/relevance: Is the result transferable to other scenarios with the same context?	yes	no	yes	yes	yes	yes	yes	no	yes	yes	yes	
	5	Are multiple lines of evidence considered?	no	no	no	no	no	no	no	/	no	no	no	
Data collection	6	Was the target population/area defined in space, time and size?	yes	yes	no	yes	yes	no	yes	no	no	yes	yes	
	7	Was a sampling population/area defined? (Which population/area was sampled?)	yes	yes	no	no	yes	yes	yes	yes	yes	yes	yes	
	8	Were potential differences between the target population and the sampling population considered?	yes	no	/	/	no	/	no	/	/	no	no	
	9	Were the methods described in sufficient detail to permit replication?	yes	yes	/	no	yes	yes	yes	no	yes	yes	yes	
	10	Was the sample size appropriate?	yes	yes	yes	no	yes	yes	no	yes	no	no	yes	
	11	**Was probability sampling used for constructing the sample?**	**/**	**/**	**/**	**/**	**no**	**no**	**no**	**no**	**no**	**no**	**no**	
	12	If secondary data are used, did an evaluation of the original data take place?	yes	yes	yes	no	/	/	/	/	/	no	/	
Analysis	13	Is the choice of statistical/analytical method justified and comprehensively explained?	yes	yes	/	/	yes	yes	yes	yes	no	/	yes	
	14	Are variables and statistical measures given?	yes	yes	/	/	yes	no	yes	yes	yes	no	yes	
	15	**Was accuracy/uncertainty assessed and reported?**	**yes**	**yes**	**/**	**no**	**no**	**yes**	**no**	**no**	**no**	**no**	**no**	
Results	16	Are results consistent and homogeneous?	yes	yes	/	yes	yes	no	yes	yes	yes	yes	yes	
	17	Magnitude of effect: Is the effect large (and without large uncertainty)	no	no	/		yes	no	no	/	no	no	no	
	18	Attrition bias: Are non-response/drop-outs given and is their impact discussed	yes	/	no	no	/	/	/	no	/	/	no	
		Design-dependent aspects:												
Review	19	Low probability of publication bias? E.g. results reporting a negative relationship were probably not included	yes	yes	no	no	/	/	/	/	/		/	
	20	**Is the review based on high evidence individual studies (several level 2 or level 3 studies)?**	**yes**	**no**	**yes**	**no**	**/**	**/**	**/**	**/**	**/**		**/**	
	21	Validity – Do the studies included respond to the same question?	yes	yes	yes	/	/	/	/	/	/		/	
	22	Was the literature searched in a systematic way?	yes	no	yes	no	/		/				/	
	24	Was a meta-analysis (in the strict sense: see Borenstein et al. 2009) indcluded?	yes	yes	no	no								
	24	Were any other quantitative summary statistics provided?	yes	yes	no	no								
Studies with a reference	25	**Selection bias: Was the assignment of case-control groups randomized?**	**/**	**/**	**/**	**/**	**no**	**no**	**/**		**/**		**/**	
	26	**Were groups designed equally, aside from the investigated point of interest?**	**/**	**/**	**/**	**/**	**no**	**yes**	**/**	**/**	**/**		**/**	
	27	Performance bias: Was the sampling blinded, e.g. researchers taking samples of a specific area wouldn't know which differences are between these areas?	/	/	/	/	no	no	/	/	/		/	
	28	Were there sufficient replicates of treatment and reference groups?	/	/	/	/	yes	yes	/	/	/		/	
		Category-dependent aspects:												
Valuation	29	Were future values of ecosystem services considered?	/	yes	/	/	/	/	/	no	/	no	/	
	30	If future values were considered, were they discounted with a well-motivated discount rate?	/	yes	/	/	/	/	/	/	/	/	/	
	31	If aggregate economic values for a population were estimated, was this estimation consistent with the sampling procedure and the definition of the population?	/	/	/	/	/	/	/	no	/	no	/	
	32	If valuation took place in form of a questionnaire, was the study pre-tested and piloted?	/	/	/	/	/	/	/	yes	/	/	/	
		Quality points	24/26	20/27	10/18	5/20	14/25	14/24	10/19	10/20	8/18	8/21	10/20	

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